

FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS

DES.

SHEET

LFSLFSst29TV23

FOR SEISMIC ZONE (4), SOIL PROFILE (Sd)

NEAR SOURCE FACTOR = 1.5

FCE
JOB No.

DATE: 4-6-04

1

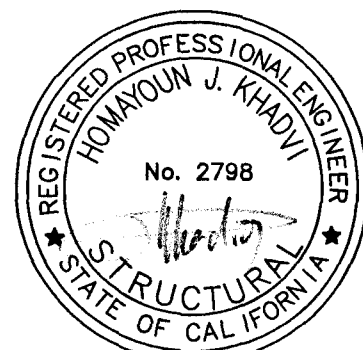
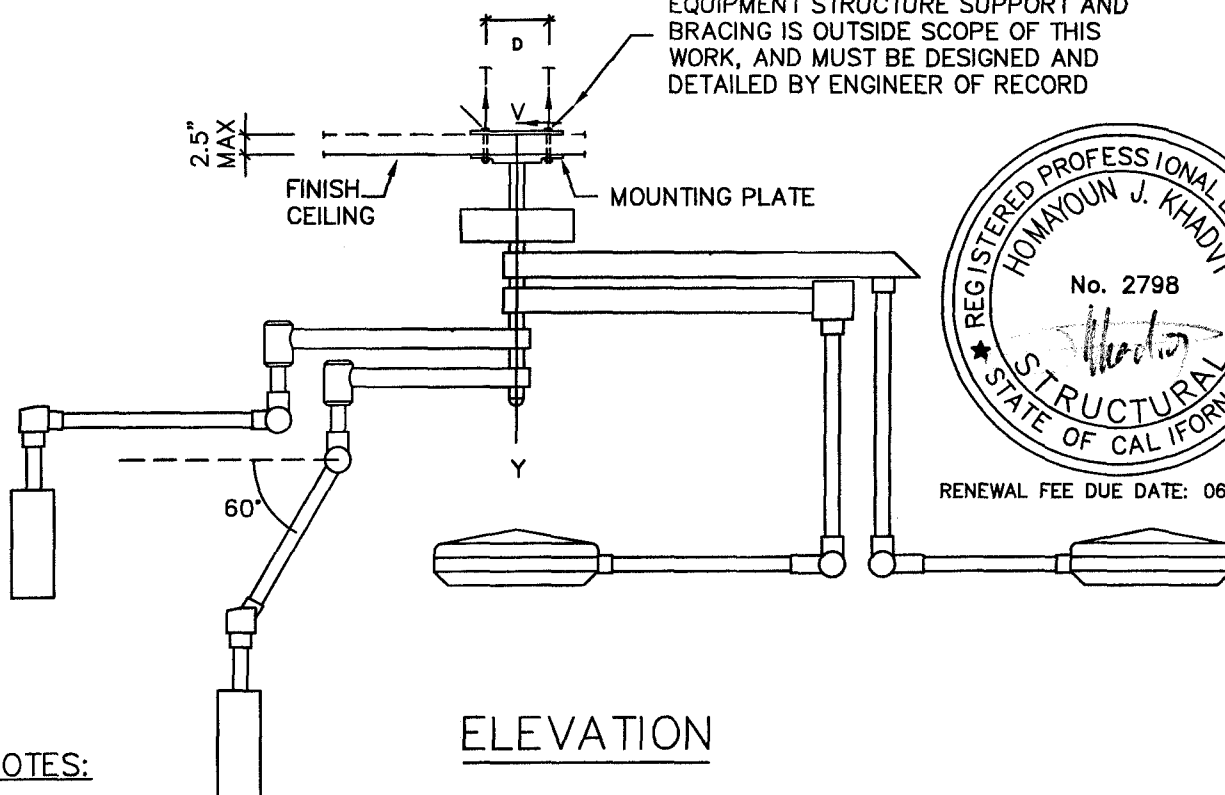
OF 4 SHEETS

SEISMIC ANCHORING BOLT DESIGN

LFSLFSst29TV23

*BY OTHERS:

EQUIPMENT STRUCTURE SUPPORT AND BRACING IS OUTSIDE SCOPE OF THIS WORK, AND MUST BE DESIGNED AND DETAILED BY ENGINEER OF RECORD



RENEWAL FEE DUE DATE: 06-30-06

ELEVATION

NOTES:

1. SCOPE OF WORK: DESIGN OF BOLTS CONNECTING MOUNTING PLATE TO STRUCTURE ONLY.
2. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE - SECTION 1632A, (INCLUDING UP TO DATE REVISIONS) AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE
3. FORCES ARE MAXIMUMS AND OCCUR WHEN EQUIPMENT IS MOVED TO ITS MOST ECCENTRIC POSITION.
4. PROVIDE CEILING STRUCTURE DESIGNED AND DETAILS TO SUPPORT WEIGHTS AND FORCES SHOWN (BY ENGINEER OF RECORD FOR THE BUILDING)
5. ENGINEER OF RECORD TO DESIGN, DETAIL AND VERIFY STRUCTURE AND/OR EXISTING LIGHT SUPPORT TRACTS TO SUPPORT INDICATED LOADS
6. HORIZONTAL FORCES AND MOMENT MAY OCCUR IN ANY DIRECTION, ACTING AT THE TOP OF MOUNTING PLATE.

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DESIGN CRITERIA:

FORMULA 32A-1: $F_p = 4.0 C_a I_p W_p$

TABLE 16A-Q : $C_a = 0.44 N_a = 0.44 * 1.5 = 0.66$ (For zone 4 & Sd)

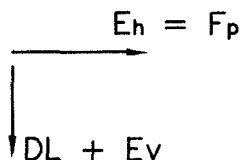
TABLE 16A-K : $I_a = 1.5$ (For essential facility)
 $\therefore F_p = (4.0)(0.66)(1.5)W_p = 3.96 W_p$ (For LRFD)
 $F_p = 3.96 W_p / 1.4 = 2.83 W_p$ (For ASD)

FORMULA 30A-1: $E = p E_h + E_v$
 $E_h = F_p$
 $p = 1.0$ (FOR COMPONENT)

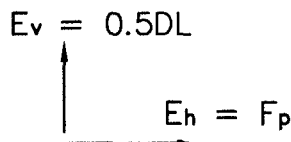
$$\begin{aligned} E_v &= (0.5) C_a I_p W_p \\ &= (0.5)(0.66)(1.5)W_p = 0.5 W_p \text{ (For LRFD)} \\ &= 0 \text{ (For ASD)} \end{aligned}$$

SECTION 1630A.11: $E_v = (0.7) C_a I W_p$
 $= (0.7)(0.66)(1.5)/1.4 = 0.5 W_p$ (For ASD) [NET UPLIFT FORCE]

LOAD COMBINATION CASE A



LOAD COMBINATION CASE B



BY COMPARISON LOAD, COMBINATION A GOVERNS

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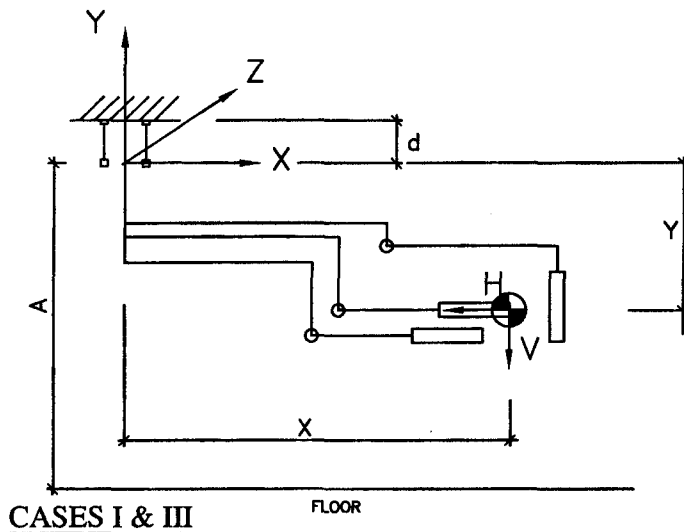
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A: MAX FLOOR TO MOUNTING PLATE DISTANCE

$$A = 10'-0" = 120"$$

Vd : Dead Load (= DL)

Ve : Vertical Seismic Load (= Ev)

He : Horizontal Seismic Load (= Eh)

CASE I (FIXTURE AT HIGH POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 135.0 + 135.0 + 125.0 + 100.0 = 495.0 \#$$

$$Y = 120.0 - 80.0 = 40.0"$$

$$X = (135.0 \times 90.1 + 135.0 \times 82.5 + 125.0 \times 78.3 + 100.0 \times 62.8) / 495 = 79.5"$$

$$Ve = 0.50 \times 495.0 = 245.0 \#$$

$$He = 2.83 \times 495.0 = 1400.1 \#$$

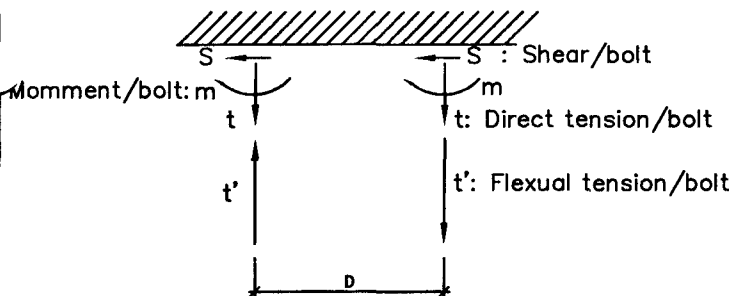
$$S = 1400.1 / 4.0 = 350.0 \#$$

$$t = (495.0 + 245.0) / 4 = 185 \#$$

$$\text{Total } M_{zz} = (495.0 + 245.0) \times 79.5 + 1400.1 \times 40.0 = 114862 \text{ "}\#$$

$$t' = 114862 / (9.5 \times 2) = 6045 \#$$

$$m = 350 \times 2.5 = 875.1 \text{ "}\#$$



CASE II (FIXTURE AT LOW POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 495.0 \#$$

$$Y = [(120.0 - 34.6) \times 135.0 + (120.0 - 34.6) \times 135.0 + (40.0 + 43.0) \times 125.0 + (40.0 + 35.3) \times 100.0] / 495.0 = 82.8"$$

$$X = [(50.6 + 39.5 \times \cos(60)) \times 135.0 + (43.0 + 39.5 \times \cos(60)) \times 135.0 + 35.3 \times 125.0 + 27.5 \times 100.0] / 495.0 = 50.8"$$

$$Ve = 0.50 \times 495.0 = 245.0 \#$$

$$He = 2.83 \times 495.0 = 1400.1 \#$$

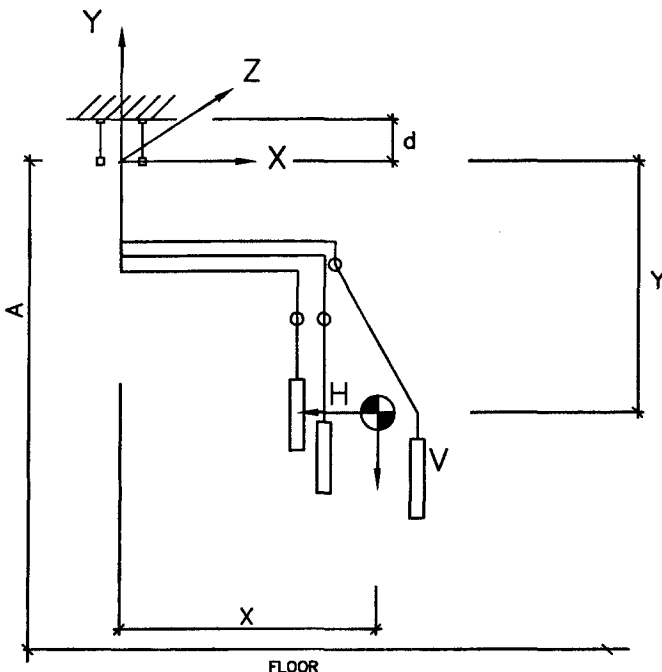
$$S = 1400.1 / 4.0 = 350.0 \#$$

$$t = (495.0 + 245.0) / 4 = 185 \#$$

$$\text{Total } M_{zz} = (495.0 + 245.0) \times 50.8 + 1400.1 \times 82.8 = 153438 \text{ "}\#$$

$$t' = 153438 / (9.5 \times 2) = 8076 \#$$

$$m = 350 \times 2.5 = 875 \text{ "}\#$$



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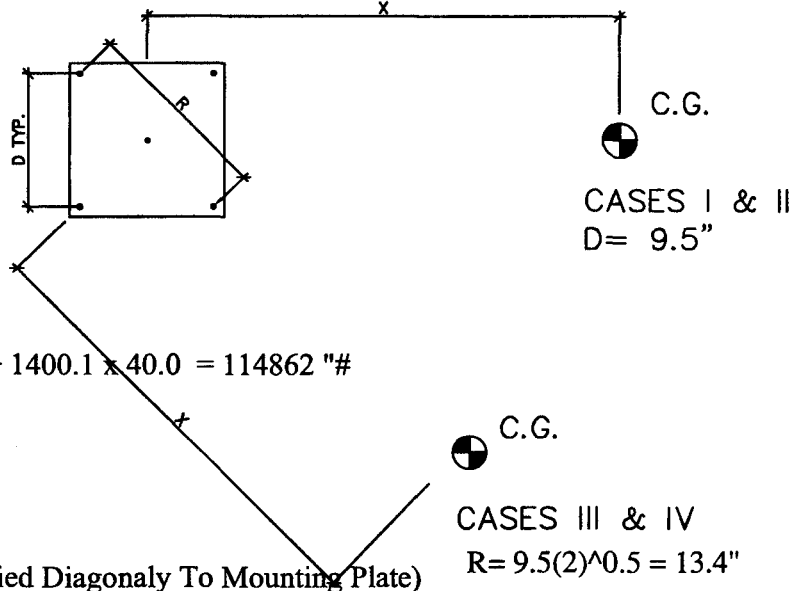
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CASE III (Same As CASE I, Lateral Forces Applied Diagonally To Mounting Plate)

$$\begin{aligned} d &= 2.5 \text{ "} \\ D &= 13.4 \text{ "} \\ V_d &= 495.0 \text{ \#} \\ Y &= 40.0 \text{ "} \\ X &= 79.5 \text{ "} \\ V_e &= 0.50 \times 495.0 = 245.0 \text{ \#} \\ H_e &= 2.83 \times 495.0 = 1400.1 \text{ \#} \\ S &= 1400.1 / 4.0 = 350.0 \text{ \#} \\ t &= (495.0 + 245.0) / 4 = 185 \text{ \#} \\ \text{Total } M_{zz} &= (495.0 + 245.0) \times 79.5 + 1400.1 \times 40.0 = 114862 \text{ "\#} \\ t' &= 114862 / (13.4 \times 1) = 8549 \text{ \#} \\ m &= 350 \times 2.5 = 875 \text{ "\#} \end{aligned}$$



CASE IV

(Same As CASE II, Lateral Forces Applied Diagonally To Mounting Plate)

$$\begin{aligned} d &= 2.5 \text{ "} \\ D &= 13.4 \text{ "} \\ V_d &= 495.0 \text{ \#} \\ Y &= 82.8 \text{ "} \\ X &= 50.8 \text{ "} \\ V_e &= 0.50 \times 495.0 = 245.0 \text{ \#} \\ H_e &= 2.83 \times 495.0 = 1400.1 \text{ \#} \\ S &= 1400.1 / 4.0 = 350.0 \text{ \#} \\ t &= (495.0 + 245.0) / 4 = 185 \text{ \#} \\ \text{Total } M_{zz} &= (495.0 + 245.0) \times 50.8 + 1400.1 \times 82.8 = 153438 \text{ "\#} \\ t' &= 153438 / (13.4 \times 1) = 11421 \text{ \#} \text{ GOVERNS} \\ m &= 350 \times 2.5 = 875 \text{ "\#} \end{aligned}$$

C.G.
CASES III & IV
 $R = 9.5(2)^{0.5} = 13.4 \text{ "}$

CHECK 7/8" DIA. A490 BOLTS:

ALLOWABLE TENSION: 32500 #
ALLOWABLE SHEAR: 12600 #

$$\begin{aligned} S &= 3.14 \times d^3 / 32 = 3.14 \times (0.88)^3 / 32.0 = 0.07 \text{ "}^3 \\ f_b &= 875.1 / 0.07 = 13312 \text{ PSI} \\ F_b &= 0.75 \times 36000 = 27000 \text{ PSI} \end{aligned}$$

$$f_v / F_v + f_t / F_t + f_b / F_b = 0.03 + 0.35 + 0.49 = 0.87 < 1.0 \text{ OK}$$

USE 7/8" DIA. A490 BOLTS